ALKOR-Berichte

Hydroacoustic Seafloor Monitoring and Hydrodynamics West of Sylt and Northeast of Helgoland (German Bight)

Cruise No. AL519-1

23.01.2019 – 07.02.2019
Kiel (Germany) – Bremerhaven (Germany)
STENCIL

Finn Mielck

Dr. Finn Mielck
Alfred-Wegener-Institute
List auf Sylt

2020

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1 Cruise Summary

1.1 Summary in English

The cruise AL519-1 was executed in the frame of BMBF research project STENCIL (strategies and tools for environment-friendly shore nourishments as climate change impact low-regret measures). It is a joint project between the Alfred Wegener Institute for Polar and Marine Research in List on Sylt, RWTH Aachen University, Forschungszentrum Küste in Hannover, Leichtweiß-Institute für Wasserbau in Braunschweig and Ludwig-Franzius-Institute in Hannover. The project aims to make the first step of a longer term vision towards an ICZM (integrated coastal zone management) and EAM (Ecosystem Approach to Management) for shore nourishments. The focus is the German Wadden Sea with the island of Sylt as the pilot site. During the cruise, several hydroacoustic devices were deployed within three different survey areas. The measurements took place in the context of a monitoring program, which investigates the hydrodynamic and morphodynamic conditions in the area of the largest sand mining site in the German Bight. The aim is to figure out which impacts on marine habitats occur because of the human activities. Within the excavation pits (depth of max. 20 m), only a very slow refill with muddy material is noticeable while the habitats in this area are permanently changed. However, the marine habitat in immediate vicinity seems unaffected.

1.2 Zusammenfassung

Die Forschungsfahrt AL519-1 findet im Rahmen des BMBF-Projektes STENCIL (strategies and tools for environment-friendly shore nourishments as climate change impact low-regret measures) statt. Dabei handelt es sich um ein Verbundprojekt zwischen dem Alfred-Wegener-Institut für Polar- und Meeresforschung in List auf Sylt, der RWTH Aachen University, dem Forschungszentrum Küste Hannover, dem Leichtweiß-Institut für Wasserbau Braunschweig und dem Ludwig-Franzius-Institut Hannover. Ziel des Projektes ist eine Grundsteinlegung zur Etablierung eines integrierten Küsten-Zonen-Managements (IKZM) und einen Ökosystem basierten Managementansatz (EAM) für Sandaufspülungen im Küstenbereich zu leisten. Das Fokus liegt dabei im deutschen Wattenmeer und bei der Insel Sylt. Während der Forschungsreise wurden diverse hydroakustische Messungen in insgesamt drei unterschiedlichen Untersuchungsgebieten durchgeführt.

Die Messungen erfolgten im Rahmen eines Monitoringprogrammes, welches die hydrodynamischen sowie morphodynamischen Bedingungen im Bereich des größten marinen Sandentnahmegebietes in der Deutschen Bucht untersucht. Dadurch werden auch die Auswirkungen des menschlichen Eingreifens auf die betroffenen Habitate erforscht. In den Entnahmetrichter (Tiefe max. 20 m) findet nur eine sehr langsame Verfüllung mit eher siltigen Material statt. Durch den Eingriff verändern sich auch die Habitate am Meeresgrund. Gebiete in unmittelbarer Nachbarschaft zu dem Entnahmestellen scheinen jedoch nicht durch die Sandentnahme betroffen zu sein.

2 Participants

2.1 Principal Investigators

Name	Institution
Dr. Mielck, Finn	AWI

2.2 Scientific Party

Name	Discipline	Institution
Dr. Mielck, Finn	Hydroacoustics / Chief Scientist	AWI
Ganal, Caroline	Coastal Engineering	RWTH
Hertel, Sarah	Student	AWI
Rolfing, Kathrin	Student	RWTH
Müller-Maatsch, Freya	Student	RWTH
Lachmann, Theresa	Student	RWTH
Paeprer, Charlotte Christine	Student	RWTH
Krivanek, Alex	Student	UW
Schneider, Marcel	Student	RWTH

2.3 Participating Institutions

AWI	Alfred Wegener Institut – Helmholtz-Zentrum für Polar- und Meeresforschung
RWTH	Rheinisch-Westfälische Technische Hochschule Aachen
UW	Universität Wien

2.4 Crew

Name	Rank
Lass, Jan P.	Master
Sossna, Yves M.	1st Officer
Eilts, Enno	2nd Officer
Kasten, Stefan	Chief Engineer
Stöck, Thorsten	Electrician
Schwieger, Hardy	Boatswain
Delachaux dit-Gay, Lucian	A.B.
Rieger, Willi	A.B.
Grunert, Holger	A.B.
Schnieders, Ken	A.B.
Kirschnick, Thomas	Cook

3 Research Program

3.1 Description of the Work Area

The working areas lie in the North Sea near the coasts of the island of Sylt and Helgoland (Fig. 3.1). Here, water depths range between 12 and 35 meters. While the area west of Sylt is mainly composed of Holocene and Pleistocene sand, the seafloor of the study site next to Helgoland is often composed of hard rock.

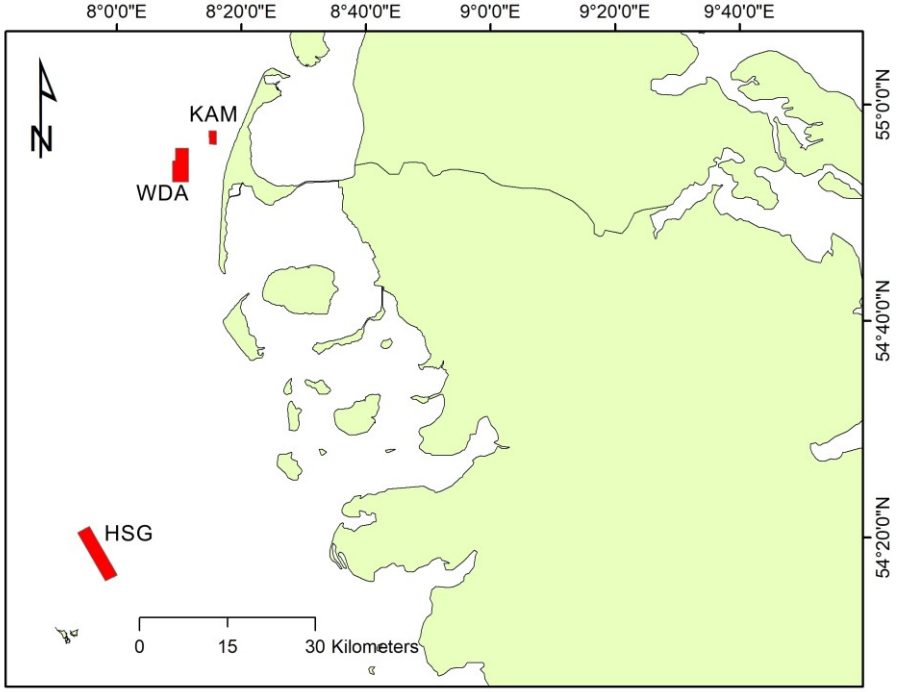

Figure 3.1: Study areas (red) during AL-519-1 located in the German Bight (SE-North Sea).

3.2 Aims of the Cruise

This cruise is part of a monitoring program, which was established by the joint research project STENCIL. The aim is to assess the impact of human activity on the seafloor. The area west of Westerland/Sylt specifically (WDA, Fig, 3.1) shows strong morphological changes within a small period of time, caused by intensive sand mining. The study areas KAM and HSG serve as reference areas.

Main goal of this survey was area-wide hydroacoustic mapping of the three study areas using two different sidescan sonars with different frequencies as well as a multibeam echosounder. Sidescan sonars were used to detect the acoustic backscatter properties of the seafloor while the multibeam echosounder delivered gapless information about the bathymetric conditions. Simultaneous, SES profiles were measured to gather values about the thickness of the upper sediment layers. The measurements will also give important information about hydrodynamic and morphological processes in proximity to vulnerable coast lines.

In order to ground-truth all hydroacoustic information, several sediment samples were taken. Additionally, CTD-profiles were measured to calibrate the hydroacoustic gear. Current measurements (with ADCP) were done to characterize the flow conditions during the tide-cycles.

3.3 Agenda of the Cruise

At the beginning of the cruise, WDA was surveyed with sidescan sonars, multibeam echosounder and SES. Before the measurement started, CTD-profiles were taken and ADCP measurements were made directly over a very fresh excavation pit that has an overall water depth of ~30 meters. Additionally, a mooring mounted with a second ADCP was deployed on the seafloor next to the excavation pit.

In order to achieve full bathymetric coverage in the relatively shallow waters (the beam width of the multibeam depends on water depth) 56 profiles with a lateral distance of 50 m were surveyed. In total, they had a length of 170 sm. Vessel speed was at 5 knots. After the survey, some small gaps that appeared in the bathymetric map were closed by taking additional measurements. The collected backscatter information was merged to a mosaic and directly post-processed onboard. Meanwhile, additional ADCP measurements were done over an approx. 20 year old excavation pit, which has a water depth of ~20 m. The measurements were done at night over one tidal cycle. After post-pressing of the backscatter data, it was possible to identify noticeable locations on the seafloor (e.g. coarse sand patterns, muddy areas etc.) where grab samples for ground-truthing were taken. Altogether, 55 samples were collected with a VanVeen grab sampler. The sediment was used for a grain-size analysis and was also examined for its macrobenthic fauna afterwards. Additionally, environmental DNA (eDNA) samples were taken.

We tried to take some underwater videos, however, the water was unfortunately too turbid that winter season.

The above procedure was repeated in the survey area KAM, except no eDNA samples were taken. In KAM, 28 profiles with a total length of 40 sm were surveyed at a speed of 5 knots. After, 15 sediment samples were taken for ground-truthing. Again, it was not possible to record underwater videos.

After a transit of several hours to HSG, 49 hydroacoustic transects with a total length of 260 sm were surveyed. Sediment sampling was not always possible because of the occurrence of hard rock in this area. Hence, only 10 samples were taken. The water was too turbid for underwater videos.

4 Narrative of the Cruise

The loading of scientific equipment onto the ship started on January 22th at the GEOMAR Westshore pier. The sidescan sonars, CTD, ADCPs and the mooring were prepared for deployment. The multibeam echosounder aided by a motion sensor was installed in the moonpool of the ship. For high precision positioning (~2 cm accuracy), a dGPS antenna was mounted on the observation deck. Prior to the cruise, a reference station, which sends correction signals via VHF, was put into operation at a lighthouse on Sylt. The highly precise positioning was necessary for tidal corrections of the hydroacoustic data.

The cruise started on January 23th from Kiel. After passing the Kiel Canal, the Alkor made a stop in Brunsbüttel during the night. On January 24th, the ship reached the first study area WDA at 14:00, where the mooring was deployed. During the evening and night, ADCP measurements were done over an excavation pit at 54°54.93’N and 8°09.98’E.

In the morning of January 25th, CTD-profiles were taken to measure sound velocity for multibeam calibration. Afterwards, the scientific crew started to calibrate the multibeam echosounder on several transects to find out the roll/pitch/yaw-offsets of the device in the moonpool. In the noon, hydroacoustic measurements (sidescan sonar, multibeam, ADCP) began in WDA continuing until January 28th 4:00. Because of damage to the ship, the Alkor had to cruise to the nearest harbour, Esbjerg (Denmark), which was reached on January 28th at 9:00. After refitting, the Alkor left Esbjerg harbour on January 29th at 15:00 and reached the second survey site, KAM, at 19:00. Hydroacoustic measurements in this area were done until January 30th 12:00.

Afterwards, 50 grab samples were taken in WDA and 30 in KAM, which occurred until January 31th 20:30. After a transit of 12 hours, RV Alkor arrived in the last study area, HSG, at 7:00 on February 1st and started hydroacoustic measurements. Because of bad weather conditions, the ship left the study area on February 4th at 9:00 and entered the Helgoland harbour at 11:00. On the next day, after the storm had passed, the Alkor left Helgoland harbour and sailed to WDA in order to retrieve the ADCP-mooring. Initially, this was planned for the end of the cruise, however bad weather conditions for that point in time were forecasted. The retrieval occurred during slack water at 19:00. On February 6th at 8:00, the ship reached HSG again and proceeded with hydroacoustic measurements, which were finished at 21:30. Meanwhile 10 sediment samples were taken from the seafloor during daylight. In the morning, Alkor headed to Bremerhaven and moored at 14:00 whereupon the cruise ended.

5 Preliminary Results

5.1 Hydroacoustics

(F. Mielck and Shipboard Scientific Party)

5.1.1 System Overview and Data Processing

Sidescan Sonars

The hydroacoustic surveys were carried out with an Imagenex YellowFin Model 872 and a Tritech StarFish 990F. Both devices were combined on one depressor wing (Fig. 5.1) and towed behind the ship with a constant offset to the GPS-antenna of X=10 m and Y=-39.5 m. The YellowFin worked with a frequency of 330 kHz and a swath-width of 150 m resulting in a across-track resolution of 10 cm after post-processing. The StarFish operated with a frequency of 1000 kHz, which lead to a twofold better resolution (5 cm), however the high frequency reduced the swath-range to 68 m. Because the distance between the transects was only 50 m (necessary for gapless multibeam mapping), the study sites were mapped with an overlap of 50% (YellowFin). For post-processing of the backscatter data and the generation of sidescan-mosaics, the software package SonarWiz 5 was used.

Figure 5.1: Sidescan sonar YellowFin combined with a StarFish device (red).

Multibeam Echosounder

In order to measure the water depth and get a gapless bathymetry of the study areas, a Wärtsilä ELAC Seabeam 1000 multibeam echosounder was used (Fig, 5.2). The shallow water multibeam system operated with 126 single beams reaching a maximal swath coverage sector of 153°. It operated at a frequency of 180 kHz and was aided by a motion sensor (Fig. 5.2) to compensate for ship's movements (pitch, roll, yaw). Additionally, an underwater sound velocity probe was installed in the moonpool, which permanently delivered sound velocity information from the sea surface, which is essential for a correct beamforming of the multibeam transducer. Data acquisition was done using the software HydroStar 3.5. Roll/pitch/yaw calibration, post-processing and tide correction were achieved using HYPACK 2016a.

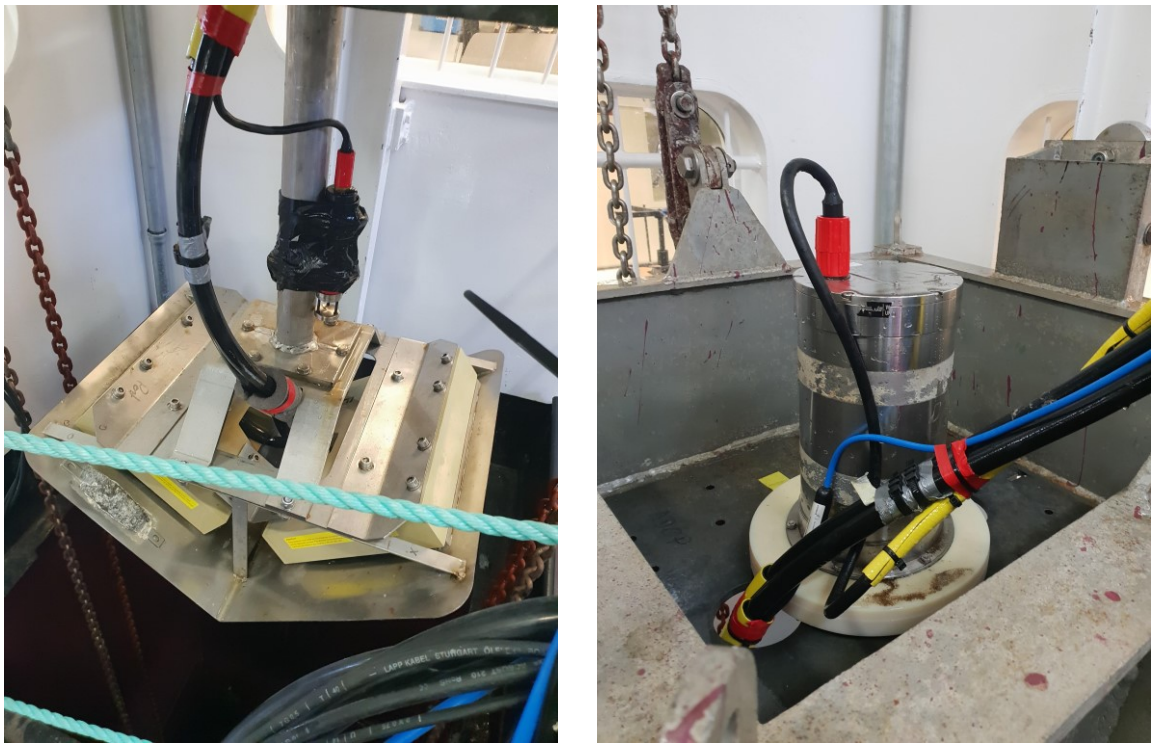

Figure 5.2: Left: Transducer of the multibeam echosounder Seabeam 1000; right: Motion sensor. Both devices were installed in the moonpool of the Alkor.

CTD, underwater camera system and ADCPs

In order to determine the sound velocity within the water column, which is necessary for correct sounding of the multibeam, several CTD profiles were taken during the survey with an ADM-CTD. It was attached to a HYDROBIOS water sampler. The HD-underwater camera (CT3009, C-Tecnics, Aberdeen) was installed on a video frame with 4 LED-lamps and a depth sensor (Fig. 5.3). Additionally, a GoPro camera was attached to that frame. Unfortunately, no underwater videos could be taken during the cruise because of turbid water. To measure current velocities during the cruise, to ADCPs (Teledyne Marine, Workhouse Sentinel) were used. One device was installed on a mooring and was lowered to the seafloor (Fig. 5.4). The other one was installed on a pole on the backboard of the ship. They worked at a frequency of 600 kHz and a cell size of 40 cm.

Fig. 5.3: AMD-CTD attached to the HYDROBIOS water sampler (left) and the underwater video system (right).

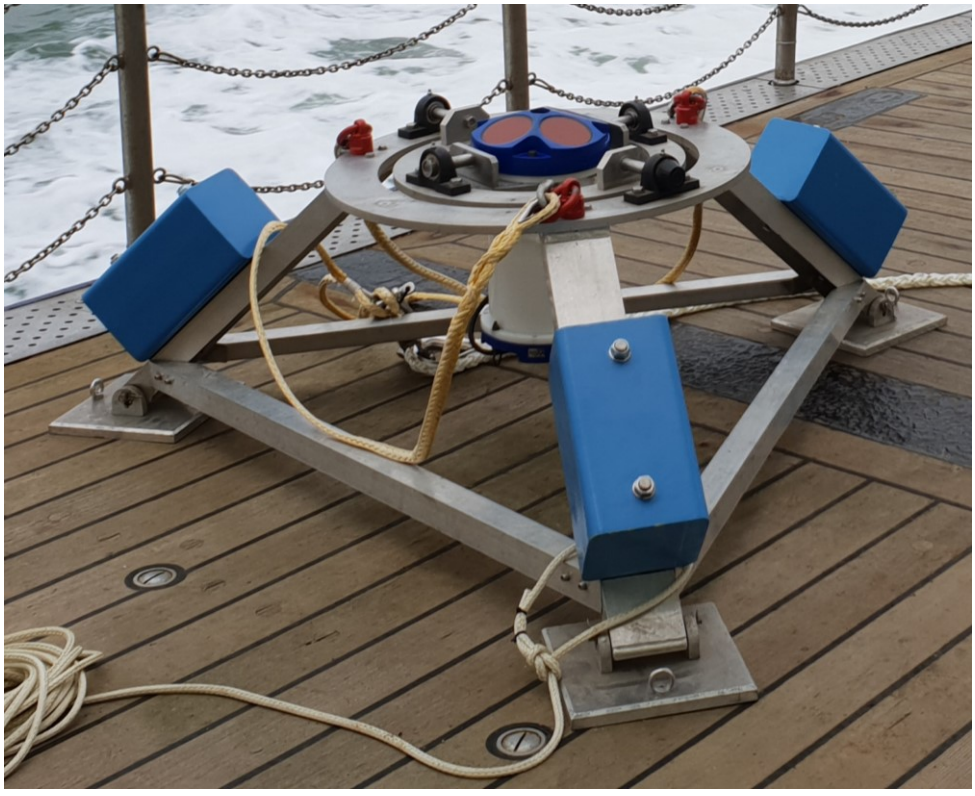

Fig. 5.4: ADCP installed on a mooring.

5.2 Expected Results

Before this survey, the study area WDA was surveyed several times by RV Heincke and RV Mya 2. During those cruises, backscatter responses and bathymetry of the seafloor were also measured and the different stages of sand extraction and re-accumulation were monitored (Mielck et al. 2019). During AL519-1, fresh excavation marks, which originate exclusively from sand mining in the year 2018, could be mapped (Fig. 5.4, deepest part in the map). Compared to measurements from 2016, 2017 and 2018, a very slow refill within class “1” in the west is observable. Grab samples taken from this area during AL519-1 revealed that a slow accumulation of muddy material occurs in the pits (Fig. 5.5).

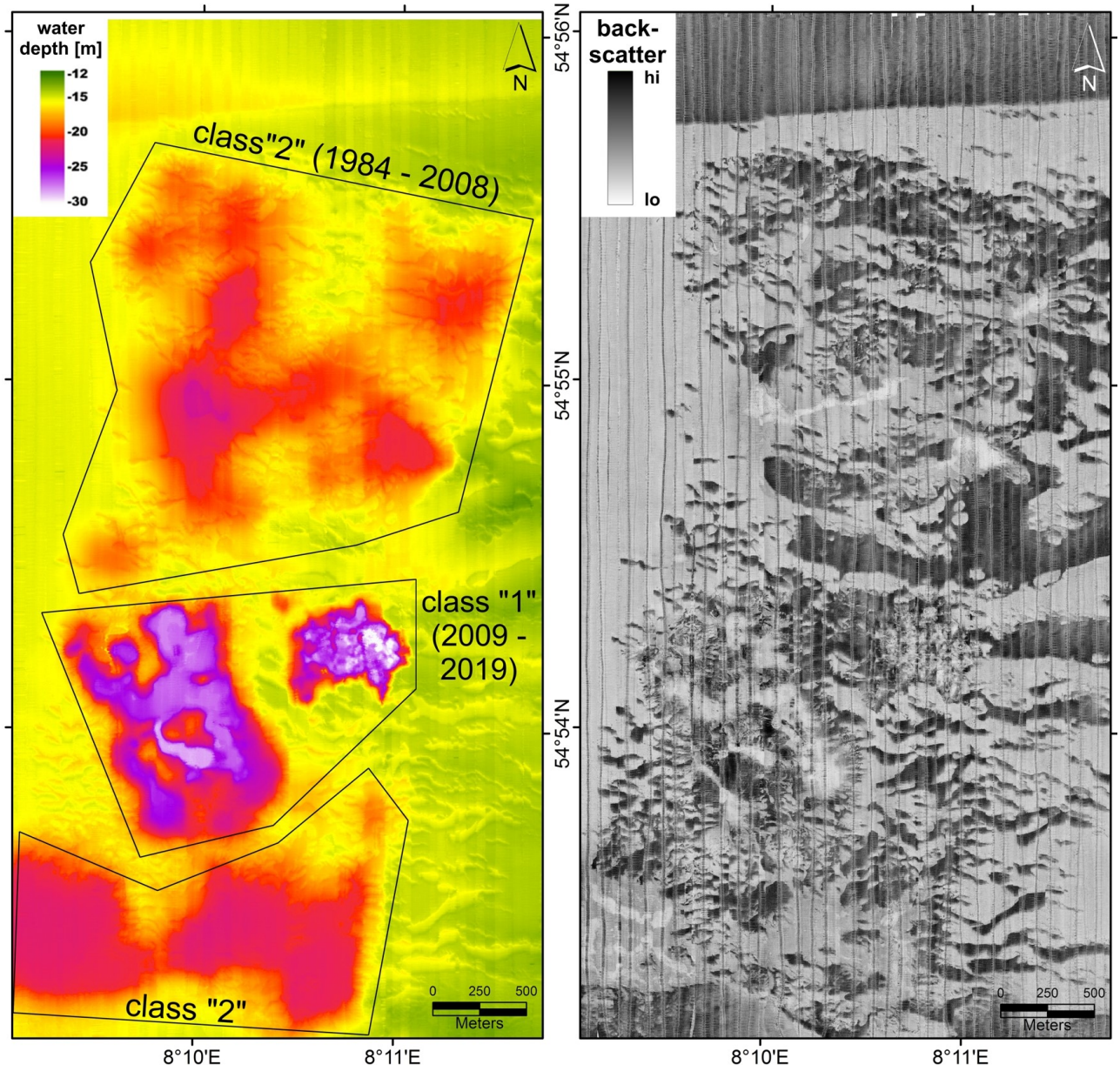

Fig. 5.4: Left: Bathymetry of the study area WDA (post-processed and tide-corrected). Class 1: Fresh dredging pits that are younger than 10 years. Class 2: Older dredging pits, which are older than 10 years. Right: Sidescan mosaic (330 kHz) of the study area. Areas with low backscatter represent muddy sediments, intermediate backscatter stands for fine sand and coarse material yields high backscatter (Mielck et al., submitted to Biogeosciences, 2020).

Fig. 5.5: Grab sample taken at a relatively fresh excavation pit in WDA shows a thin layer of muddy material, which accumulated over fine sand.

Figure 5.6 illustrates ADCP measurements, which were done over one tidal cycle in WDA.

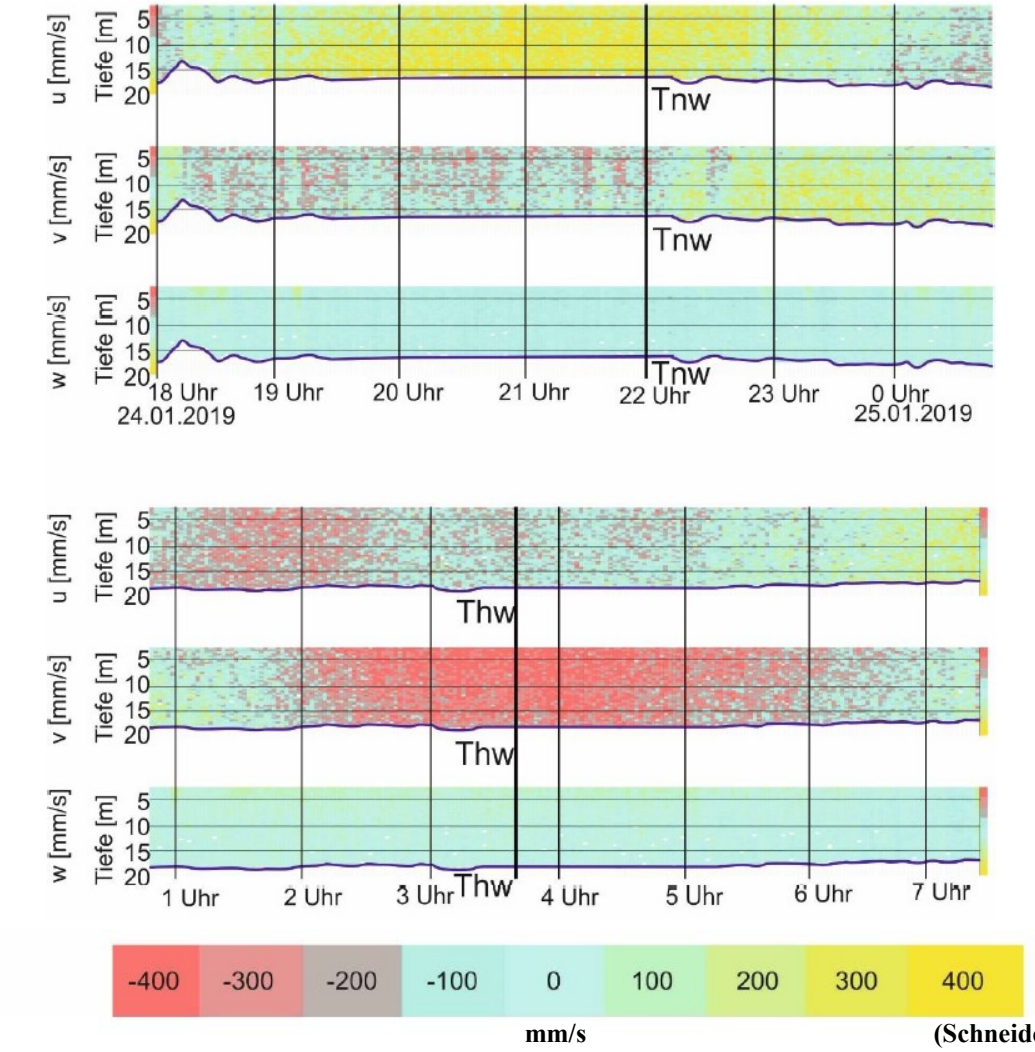

Fig. 5.6: ADCP measurements at 54°54.92'N and 8°10.01'E during one tide cycle. Tnw = low tide; Thw = high tide u = positive flow velocity in eastern direction; v = positive flow direction in northern direction; w = vertical flow

Here, vertical currents are not perceptible. The currents in the northern and eastern direction depend on the prevailing tides. The current velocities in this area are relatively weak and sometimes decrease with increasing water depth. This regime seems to allow an accumulation of muddy material in the excavation pits. In the sidescan sonar image (Fig. 5.4), the muddy areas show very low backscatter, since they are rather smooth. They can be identified as light grey domains.

The mosaic shows patterns with high backscatter responses from the seafloor. These so-called sorted bedforms are very common in the area west of Sylt and consist of rippled coarse sand off Pleistocene origin (Mielck et al. 2015). Especially in the high resolution sidescan data (StarFish; frequency of 1000 kHz), these ripples become apparent (Fig. 5.7). They usually strike north-south and are quite likely formed during storm events. The white dots in Fig. 5.7 are the acoustic shadows of small stones (diameter of approx. 10 cm). Using the acoustic shadow and the slant range/angle it is possible to calculate the sizes of the stones in sidescan sonar images.

Sorted bedforms were also observed in the study area KAM, which is located north of WDA (Fig. 5.8). Monitoring in this area revealed that these structures are not stable over the years (Mielck et al. 2015). Their shapes oscillate, indicative of movement in a northern or southern direction. This is most likely driven by storm events but also by tidal currents. Sometimes smaller bedforms disappeared over time or new bedforms emerged. However, the bedforms themselves do not move. The Holocene fine sand (light grey in the mosaic) is moving and sometimes overlays the underlying Pleistocene coarse sand.

Fig. 5.9 illustrates the sidescan mosaic form the study area HSG northeast of Helgoland. This area was, like KAM, one of six monitoring area during the joint-research project WIMO (Winter et al., 2016). Here, the seafloor is relatively heterogeneous. While hard substrates are dominating, fine, medium, and coarse sand also can be found. Hydrodynamics and morphology are likely responsible for such a zonation (Bartholomä et al., 2019).

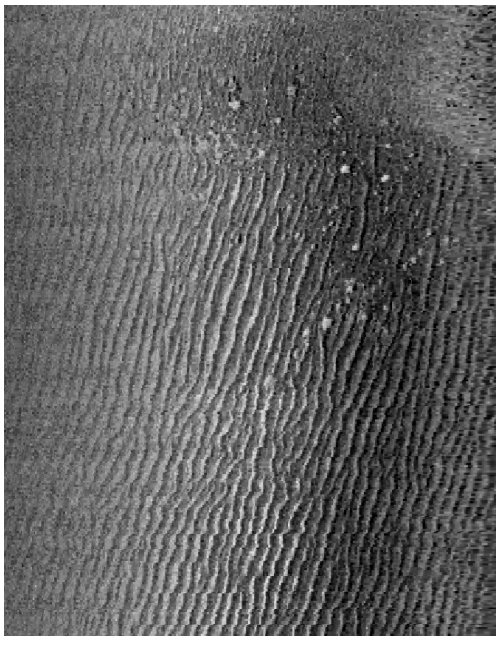

Fig. 5.7: Sidescan image in high resolution (1000 kHz, 5cm/pixel). It shows ripples with a crest-distance of ~50 cm and stones with a diameter of ~10-15 cm.

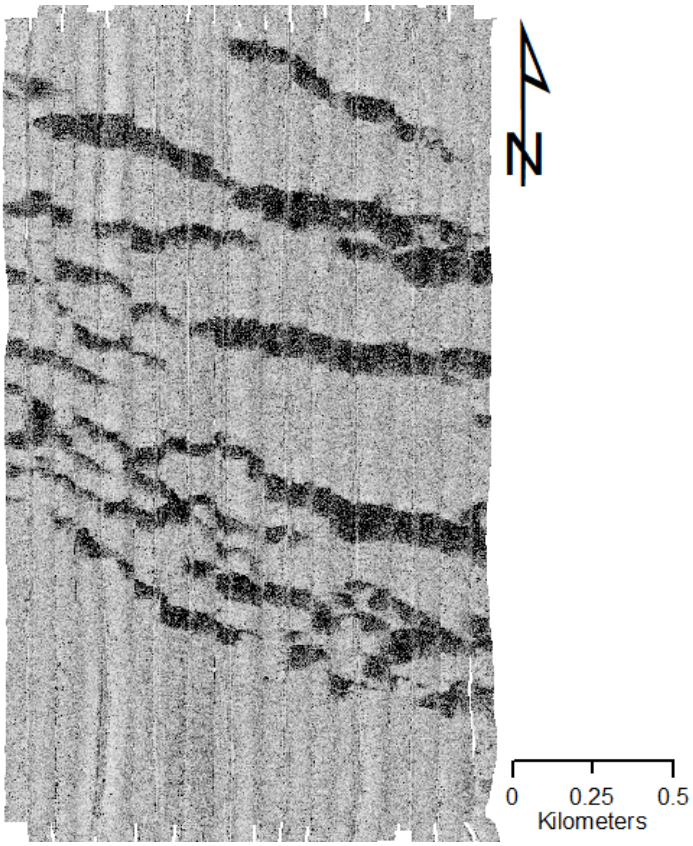

Fig. 5.8: Post-processed sidescan mosaic of the study area KAM.

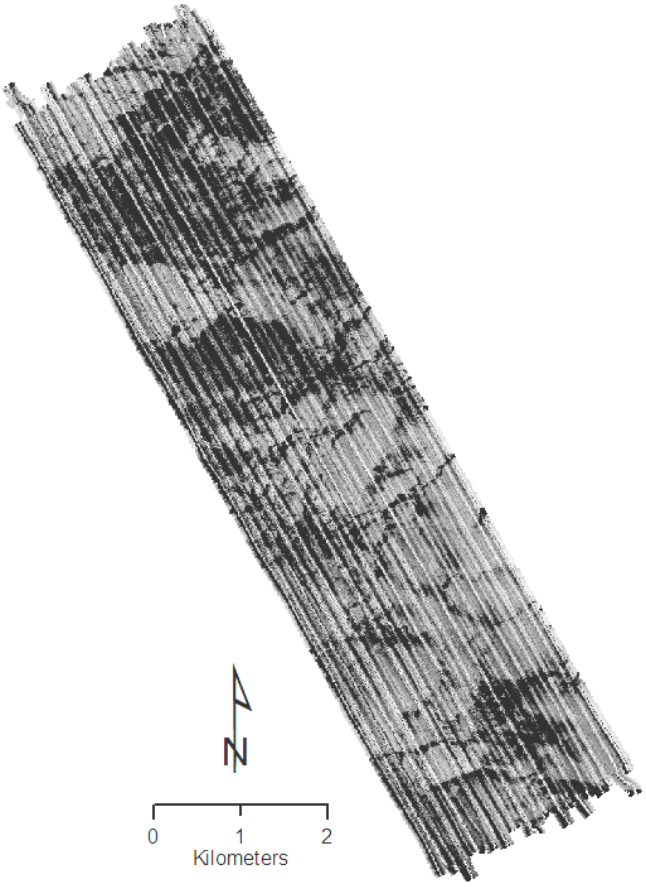

Fig. 5.9: Sidescan mosaic of the study area HSG (post-processing not finished). The dark areas represent hard rock and hard substrates.

6 Station List AL519-1

6.1 Overall Station List

Station No.		Date	Gear	Time	Latitude	Longitude	Water Depth	Remarks/ Recovery
ALKOR	AWI	2019		[UTC]	[°N]	[°E]	[m]	
AL519/1_1-1	AL519/1_1-1	24.01.	Mooring	13:49	54° 54,529'	8° 10,409'	16.8	deployed
AL519/1_1-1	AL519/1_1-1	24.01.	Mooring	14:03	54° 54,530'	8° 10,183'	18.0	at surface
AL519/1_1-2	AL519/1_1-2	24.01.	ADCP	15:59	54° 54,532'	8° 10,194'	17.5	in the water
AL519/1_1-2	AL519/1_1-2	25.01.	ADCP	09:02	54° 54,530'	8° 10,184'	17.7	on deck
AL519/1_2-1	AL519/1_2-1	25.01.	CTD	09:32	54° 55,840'	8° 11,088'	14.4	in the water
AL519/1_2-1	AL519/1_2-1	25.01.	CTD	09:38	54° 55,853'	8° 11,124'	14.4	on deck
AL519/1_3-1	AL519/1_3-1	25.01.	CTD	09:55	54° 55,444'	8° 10,176'	19.3	in the water
AL519/1_3-1	AL519/1_3-1	25.01.	CTD	10:11	54° 55,487'	8° 10,146'	19.1	on deck
AL519/1_4-1	AL519/1_4-1	25.01.	CTD	10:37	54° 54,831'	8° 11,081'	20.2	in the water
AL519/1_4-1	AL519/1_4-1	25.01.	CTD	10:45	54° 54,840'	8° 11,052'	20.3	on deck
AL519/1_5-1	AL519/1_5-1	25.01.	CTD	11:05	54° 54,307'	8° 09,913'	27.0	in the water
AL519/1_5-1	AL519/1_5-1	25.01.	CTD	11:12	54° 54,307'	8° 09,901'	26.7	on deck
AL519/1_6-1	AL519/1_6-1	25.01.	CTD	11:34	54° 53,317'	8° 10,681'	21.5	in the water
AL519/1_6-1	AL519/1_6-1	25.01.	CTD	11:40	54° 53,318'	8° 10,654'	21.8	on deck
AL519/1_7-1	AL519/1_7-1	25.01.	CTD	12:14	54° 54,942'	8° 10,003'	22.9	in the water
AL519/1_7-1	AL519/1_7-1	25.01.	CTD	12:19	54° 54,918'	8° 10,044'	23.5	on deck
AL519/1_8-1	AL519/1_8-1	25.01.	SSS/MB/SES	13:18	54° 51,523'	8° 09,365'	15.6	in the water
AL519/1_8-1	AL519/1_8-1	25.01.	SSS/MB/SES	14:09	54° 53,054'	8° 09,300'	17.2	profile start
AL519/1_8-1	AL519/1_8-1	27.01.	SSS/MB/SES	16:54	54° 53,049'	8° 09,149'	17.4	profile end
AL519/1_8-1	AL519/1_8-1	27.01.	SSS/MB/SES	16:59	54° 52,887'	8° 09,183'	16.7	on deck
AL519/1_9-1	AL519/1_9-1	27.01.	ADCP	17:31	54° 53,135'	8° 11,657'	15.9	profile start
AL519/1_9-1	AL519/1_9-1	27.01.	ADCP	20:57	54° 54,238'	8° 10,404'	16.3	profile end
AL519/1_10-1	AL519/1_10-1	28.01.	ADCP	02:57	54° 53,890'	8° 09,991'	26.1	on deck
AL519/1_11-1	AL519/1_11-1	29.01.	ADCP	18:27	54° 56,639'	8° 15,282'	0.0	in the water
AL519/1_11-1	AL519/1_11-1	29.01.	ADCP	18:32	54° 54,326'	8° 10,826'	27.5	on deck
AL519/1_12-1	AL519/1_12-1	29.01.	SSS/MB/SES	18:38	54° 56,551'	8° 15,466'	13.3	in the water
AL519/1_12-1	AL519/1_12-1	29.01.	SSS/MB/SES	18:52	54° 56,392'	8° 15,122'	11.9	profile start
AL519/1_12-1	AL519/1_12-1	30.01.	SSS/MB/SES	08:47	54° 56,460'	8° 15,903'	12.4	profile end
AL519/1_12-1	AL519/1_12-1	30.01.	SSS/MB/SES	08:51	54° 56,324'	8° 15,890'	11.9	on deck
AL519/1_13-1	AL519/1_13-1	30.01.	ADCP	09:15	54° 56,363'	8° 16,172'	12.1	profile start
AL519/1_13-1	AL519/1_13-1	30.01.	ADCP	10:51	54° 56,797'	8° 15,111'	12.1	profile end
AL519/1_14-1	AL519/1_14-1	30.01.	Grab	12:03	54° 55,807'	8° 09,778'	16.3	in the water
AL519/1_14-1	AL519/1_14-1	30.01.	Grab	12:04	54° 55,808'	8° 09,795'	16.2	on deck
AL519/1_14-2	AL519/1_14-2	30.01.	UWVS	12:33	54° 55,789'	8° 09,744'	15.9	in the water
AL519/1_14-2	AL519/1_14-2	30.01.	UWVS	12:38	54° 55,829'	8° 09,744'	16.0	on deck
AL519/1_15-1	AL519/1_15-1	30.01.	Grab	12:53	54° 55,832'	8° 10,184'	15.3	on deck
AL519/1_15-2	AL519/1_15-2	30.01.	UWVS	12:59	54° 55,832'	8° 10,174'	15.4	in the water
AL519/1_15-2	AL519/1_15-2	30.01.	UWVS	13:04	54° 55,838'	8° 10,183'	15.1	on deck
AL519/1_16-1	AL519/1_16-1	30.01.	Grab	13:12	54° 55,838'	8° 10,651'	15.3	in the water
AL519/1_16-1	AL519/1_16-1	30.01.	Grab	13:13	54° 55,841'	8° 10,653'	14.7	on deck
AL519/1_17-1	AL519/1_17-1	30.01.	Grab	13:21	54° 55,851'	8° 11,082'	14.8	in the water

AL519/1_17-1	AL519/1_17-1	30.01.	Grab	13:24	54° 55,849'	8° 11,100'	14.8	on deck
AL519/1_18-1	AL519/1_18-1	30.01.	Grab	13:31	54° 55,854'	8° 11,596'	14.9	in the water
AL519/1_18-1	AL519/1_18-1	30.01.	Grab	13:32	54° 55,857'	8° 11,600'	14.6	on deck
AL519/1_19-1	AL519/1_19-1	30.01.	Grab	13:43	54° 55,750'	8° 11,589'	13.8	in the water
AL519/1_19-1	AL519/1_19-1	30.01.	Grab	13:44	54° 55,754'	8° 11,588'	14.0	on deck
AL519/1_20-1	AL519/1_20-1	30.01.	Grab	13:55	54° 55,747'	8° 11,110'	14.3	in the water
AL519/1_20-1	AL519/1_20-1	30.01.	Grab	13:56	54° 55,752'	8° 11,110'	14.3	on deck
AL519/1_21-1	AL519/1_21-1	30.01.	Grab	14:08	54° 55,751'	8° 10,645'	14.6	in the water
AL519/1_21-1	AL519/1_21-1	30.01.	Grab	14:09	54° 55,755'	8° 10,643'	14.5	on deck
AL519/1_22-1	AL519/1_22-1	30.01.	Grab	14:18	54° 55,727'	8° 10,200'	14.8	in the water
AL519/1_22-1	AL519/1_22-1	30.01.	Grab	14:19	54° 55,731'	8° 10,199'	14.8	on deck
AL519/1_23-1	AL519/1_23-1	30.01.	Grab	14:28	54° 55,706'	8° 09,781'	15.0	in the water
AL519/1_23-1	AL519/1_23-1	30.01.	Grab	14:29	54° 55,707'	8° 09,782'	15.4	on deck
AL519/1_24-1	AL519/1_24-1	30.01.	Grab	14:38	54° 55,387'	8° 09,731'	19.1	in the water
AL519/1_24-1	AL519/1_24-1	30.01.	Grab	14:40	54° 55,394'	8° 09,740'	19.8	on deck
AL519/1_25-1	AL519/1_25-1	30.01.	Grab	14:49	54° 55,466'	8° 10,176'	19.6	in the water
AL519/1_25-1	AL519/1_25-1	30.01.	Grab	14:51	54° 55,471'	8° 10,181'	19.9	on deck
AL519/1_26-1	AL519/1_26-1	30.01.	Grab	14:59	54° 55,452'	8° 10,724'	16.0	in the water
AL519/1_26-1	AL519/1_26-1	30.01.	Grab	15:01	54° 55,461'	8° 10,732'	15.5	on deck
AL519/1_27-1	AL519/1_27-1	30.01.	Grab	15:09	54° 55,376'	8° 11,281'	17.5	in the water
AL519/1_27-1	AL519/1_27-1	30.01.	Grab	15:11	54° 55,372'	8° 11,290'	17.4	on deck
AL519/1_27-2	AL519/1_27-2	30.01.	Grab	15:12	54° 55,374'	8° 11,291'	17.3	in the water
AL519/1_27-2	AL519/1_27-2	30.01.	Grab	15:13	54° 55,382'	8° 11,300'	17.1	on deck
AL519/1_28-1	AL519/1_28-1	30.01.	Grab	15:20	54° 55,423'	8° 11,651'	14.9	in the water
AL519/1_28-1	AL519/1_28-1	30.01.	Grab	15:22	54° 55,432'	8° 11,672'	15.3	on deck
AL519/1_29-1	AL519/1_29-1	30.01.	Grab	15:33	54° 55,220'	8° 11,360'	20.0	in the water
AL519/1_29-1	AL519/1_29-1	30.01.	Grab	15:35	54° 55,236'	8° 11,354'	20.3	on deck
AL519/1_30-1	AL519/1_30-1	30.01.	Grab	15:45	54° 55,236'	8° 11,159'	20.3	in the water
AL519/1_30-1	AL519/1_30-1	30.01.	Grab	15:48	54° 55,233'	8° 11,162'	20.2	on deck
AL519/1_31-1	AL519/1_31-1	30.01.	Grab	15:58	54° 55,220'	8° 10,687'	16.4	in the water
AL519/1_31-1	AL519/1_31-1	30.01.	Grab	16:00	54° 55,232'	8° 10,682'	15.9	on deck
AL519/1_32-1	AL519/1_32-1	30.01.	Grab	16:11	54° 55,233'	8° 10,164'	21.2	in the water
AL519/1_32-1	AL519/1_32-1	30.01.	Grab	16:13	54° 55,245'	8° 10,166'	21.3	on deck
AL519/1_33-1	AL519/1_33-1	30.01.	Grab	16:22	54° 55,148'	8° 09,750'	16.6	in the water
AL519/1_33-1	AL519/1_33-1	30.01.	Grab	16:25	54° 55,162'	8° 09,759'	17.2	on deck
AL519/1_34-1	AL519/1_34-1	30.01.	Grab	16:35	54° 54,951'	8° 09,954'	23.2	in the water
AL519/1_34-1	AL519/1_34-1	30.01.	Grab	16:37	54° 54,917'	8° 09,945'	22.9	on deck
AL519/1_35-1	AL519/1_35-1	30.01.	Grab	17:02	54° 54,971'	8° 10,404'	20.9	in the water
AL519/1_35-1	AL519/1_35-1	30.01.	Grab	17:03	54° 54,982'	8° 10,394'	20.5	on deck
AL519/1_36-1	AL519/1_36-1	31.01.	Grab	07:06	54° 54,836'	8° 11,102'	21.6	in the water
AL519/1_36-1	AL519/1_36-1	31.01.	Grab	07:09	54° 54,830'	8° 11,090'	22.1	on deck
AL519/1_37-1	AL519/1_37-1	31.01.	Grab	07:18	54° 54,682'	8° 11,546'	14.4	in the water
AL519/1_37-1	AL519/1_37-1	31.01.	Grab	07:22	54° 54,684'	8° 11,498'	15.0	on deck
AL519/1_38-1	AL519/1_38-1	31.01.	Grab	07:30	54° 54,546'	8° 11,135'	16.8	in the water
AL519/1_38-1	AL519/1_38-1	31.01.	Grab	07:32	54° 54,546'	8° 11,139'	17.2	on deck
AL519/1_39-1	AL519/1_39-1	31.01.	Grab	07:41	54° 54,710'	8° 10,130'	20.5	in the water
AL519/1_39-1	AL519/1_39-1	31.01.	Grab	07:43	54° 54,706'	8° 10,148'	20.4	on deck

AL519/1_40-1	AL519/1_40-1	31.01.	Grab	07:52	54° 54,321'	8° 10,827'	26.3	in the water
AL519/1_40-1	AL519/1_40-1	31.01.	Grab	08:03	54° 54,347'	8° 10,824'	28.7	on deck
AL519/1_41-1	AL519/1_41-1	31.01.	Grab	08:09	54° 54,251'	8° 10,643'	27.0	in the water
AL519/1_41-1	AL519/1_41-1	31.01.	Grab	08:10	54° 54,256'	8° 10,649'	28.5	on deck
AL519/1_42-1	AL519/1_42-1	31.01.	Grab	08:28	54° 54,314'	8° 09,871'	28.3	in the water
AL519/1_42-1	AL519/1_42-1	31.01.	Grab	08:28	54° 54,315'	8° 09,871'	28.5	on deck
AL519/1_43-1	AL519/1_43-1	31.01.	Grab	08:35	54° 54,495'	8° 09,591'	20.1	in the water
AL519/1_43-1	AL519/1_43-1	31.01.	Grab	08:37	54° 54,496'	8° 09,599'	19.9	on deck
AL519/1_44-1	AL519/1_44-1	31.01.	Grab	08:44	54° 54,228'	8° 09,431'	22.1	in the water
AL519/1_44-1	AL519/1_44-1	31.01.	Grab	08:46	54° 54,227'	8° 09,438'	22.2	on deck
AL519/1_45-1	AL519/1_45-1	31.01.	Grab	08:53	54° 54,081'	8° 09,697'	26.8	in the water
AL519/1_45-1	AL519/1_45-1	31.01.	Grab	08:55	54° 54,083'	8° 09,649'	26.4	on deck
AL519/1_46-1	AL519/1_46-1	31.01.	Grab	09:04	54° 54,079'	8° 10,082'	27.8	in the water
AL519/1_46-1	AL519/1_46-1	31.01.	Grab	09:10	54° 54,095'	8° 10,084'	28.1	on deck
AL519/1_47-1	AL519/1_47-1	31.01.	Grab	09:17	54° 53,924'	8° 09,962'	29.2	in the water
AL519/1_47-1	AL519/1_47-1	31.01.	Grab	09:23	54° 53,932'	8° 09,962'	29.0	on deck
AL519/1_48-1	AL519/1_48-1	31.01.	Grab	09:29	54° 53,791'	8° 09,820'	26.2	in the water
AL519/1_48-1	AL519/1_48-1	31.01.	Grab	09:32	54° 53,786'	8° 09,831'	26.4	on deck
AL519/1_49-1	AL519/1_49-1	31.01.	Grab	09:40	54° 53,738'	8° 10,115'	23.8	in the water
AL519/1_49-1	AL519/1_49-1	31.01.	Grab	09:42	54° 53,737'	8° 10,111'	23.8	on deck
AL519/1_50-1	AL519/1_50-1	31.01.	Grab	09:48	54° 53,800'	8° 10,359'	21.3	in the water
AL519/1_50-1	AL519/1_50-1	31.01.	Grab	09:50	54° 53,806'	8° 10,360'	21.9	on deck
AL519/1_51-1	AL519/1_51-1	31.01.	Grab	09:59	54° 53,983'	8° 10,703'	16.3	in the water
AL519/1_51-1	AL519/1_51-1	31.01.	Grab	10:01	54° 53,987'	8° 10,701'	16.6	on deck
AL519/1_52-1	AL519/1_52-1	31.01.	Grab	10:33	54° 54,164'	8° 11,203'	15.0	in the water
AL519/1_52-1	AL519/1_52-1	31.01.	Grab	10:34	54° 54,167'	8° 11,200'	15.2	on deck
AL519/1_53-1	AL519/1_53-1	31.01.	Grab	10:42	54° 53,926'	8° 11,499'	15.1	in the water
AL519/1_53-1	AL519/1_53-1	31.01.	Grab	10:43	54° 53,930'	8° 11,515'	15.2	on deck
AL519/1_54-1	AL519/1_54-1	31.01.	Grab	10:58	54° 53,512'	8° 10,709'	21.6	in the water
AL519/1_54-1	AL519/1_54-1	31.01.	Grab	10:59	54° 53,518'	8° 10,688'	21.2	on deck
AL519/1_55-1	AL519/1_55-1	31.01.	Grab	11:08	54° 53,510'	8° 11,176'	15.3	in the water
AL519/1_55-1	AL519/1_55-1	31.01.	Grab	11:09	54° 53,509'	8° 11,178'	15.6	on deck
AL519/1_56-1	AL519/1_56-1	31.01.	Grab	11:17	54° 53,327'	8° 11,474'	14.5	in the water
AL519/1_56-1	AL519/1_56-1	31.01.	Grab	11:18	54° 53,325'	8° 11,469'	14.6	on deck
AL519/1_57-1	AL519/1_57-1	31.01.	Grab	11:27	54° 53,171'	8° 11,340'	14.0	in the water
AL519/1_57-1	AL519/1_57-1	31.01.	Grab	11:28	54° 53,176'	8° 11,341'	14.2	on deck
AL519/1_58-1	AL519/1_58-1	31.01.	Grab	11:39	54° 53,290'	8° 10,661'	22.0	in the water
AL519/1_58-1	AL519/1_58-1	31.01.	Grab	11:41	54° 53,286'	8° 10,657'	22.7	on deck
AL519/1_59-1	AL519/1_59-1	31.01.	Grab	11:51	54° 53,422'	8° 10,318'	22.2	in the water
AL519/1_59-1	AL519/1_59-1	31.01.	Grab	11:52	54° 53,418'	8° 10,333'	21.7	on deck
AL519/1_60-1	AL519/1_60-1	31.01.	Grab	12:03	54° 53,322'	8° 09,857'	20.3	in the water
AL519/1_60-1	AL519/1_60-1	31.01.	Grab	12:05	54° 53,316'	8° 09,860'	20.2	on deck
AL519/1_61-1	AL519/1_61-1	31.01.	Grab	12:14	54° 53,396'	8° 09,341'	22.1	in the water
AL519/1_61-1	AL519/1_61-1	31.01.	Grab	12:17	54° 53,399'	8° 09,358'	21.7	on deck
AL519/1_62-1	AL519/1_62-1	31.01.	Grab	12:30	54° 53,484'	8° 09,303'	22.5	in the water
AL519/1_62-1	AL519/1_62-1	31.01.	Grab	12:32	54° 53,480'	8° 09,312'	22.0	on deck
AL519/1_63-1	AL519/1_63-1	31.01.	Grab	12:40	54° 53,501'	8° 09,292'	22.2	in the water

AL519/1_63-1	AL519/1_63-1	31.01.	Grab	12:41	54° 53,495'	8° 09,275'	22.0	on deck
AL519/1_64-1	AL519/1_64-1	31.01.	Grab	12:50	54° 53,552'	8° 09,309'	21.8	in the water
AL519/1_64-1	AL519/1_64-1	31.01.	Grab	12:51	54° 53,551'	8° 09,307'	21.2	on deck
AL519/1_65-1	AL519/1_65-1	31.01.	Grab	12:59	54° 53,608'	8° 09,315'	0.0	in the water
AL519/1_65-1	AL519/1_65-1	31.01.	Grab	13:00	54° 53,604'	8° 09,306'	20.3	on deck
AL519/1_66-1	AL519/1_66-1	31.01.	Grab	13:05	54° 53,632'	8° 09,315'	20.0	in the water
AL519/1_66-1	AL519/1_66-1	31.01.	Grab	13:06	54° 53,635'	8° 09,310'	19.6	on deck
AL519/1_67-1	AL519/1_67-1	31.01.	Grab	13:12	54° 53,681'	8° 09,294'	17.9	in the water
AL519/1_67-1	AL519/1_67-1	31.01.	Grab	13:13	54° 53,681'	8° 09,302'	17.1	on deck
AL519/1_68-1	AL519/1_68-1	31.01.	Grab	13:19	54° 53,724'	8° 09,300'	15.7	in the water
AL519/1_68-1	AL519/1_68-1	31.01.	Grab	13:21	54° 53,720'	8° 09,299'	16.1	on deck
AL519/1_69-1	AL519/1_69-1	31.01.	Grab	14:02	54° 57,605'	8° 15,109'	13.2	in the water
AL519/1_69-1	AL519/1_69-1	31.01.	Grab	14:03	54° 57,605'	8° 15,098'	13.0	on deck
AL519/1_70-1	AL519/1_70-1	31.01.	Grab	14:16	54° 57,599'	8° 15,307'	13.7	in the water
AL519/1_70-1	AL519/1_70-1	31.01.	Grab	14:17	54° 57,600'	8° 15,306'	13.6	on deck
AL519/1_71-1	AL519/1_71-1	31.01.	Grab	14:26	54° 57,612'	8° 15,538'	12.5	in the water
AL519/1_71-1	AL519/1_71-1	31.01.	Grab	14:27	54° 57,606'	8° 15,540'	12.5	on deck
AL519/1_72-1	AL519/1_72-1	31.01.	Grab	14:37	54° 57,604'	8° 15,769'	12.0	in the water
AL519/1_72-1	AL519/1_72-1	31.01.	Grab	14:39	54° 57,597'	8° 15,762'	11.8	on deck
AL519/1_73-1	AL519/1_73-1	31.01.	Grab	14:50	54° 57,603'	8° 16,010'	0.0	in the water
AL519/1_73-1	AL519/1_73-1	31.01.	Grab	14:52	54° 57,601'	8° 16,008'	11.9	on deck
AL519/1_74-1	AL519/1_74-1	31.01.	Grab	15:08	54° 57,390'	8° 16,049'	12.3	in the water
AL519/1_74-1	AL519/1_74-1	31.01.	Grab	15:10	54° 57,393'	8° 16,059'	11.2	on deck
AL519/1_75-1	AL519/1_75-1	31.01.	Grab	15:19	54° 57,401'	8° 15,785'	12.0	in the water
AL519/1_75-1	AL519/1_75-1	31.01.	Grab	15:21	54° 57,403'	8° 15,794'	11.9	on deck
AL519/1_76-1	AL519/1_76-1	31.01.	Grab	15:28	54° 57,415'	8° 15,600'	11.6	in the water
AL519/1_76-1	AL519/1_76-1	31.01.	Grab	15:30	54° 57,413'	8° 15,593'	12.0	on deck
AL519/1_77-1	AL519/1_77-1	31.01.	Grab	15:39	54° 57,430'	8° 15,336'	12.4	in the water
AL519/1_77-1	AL519/1_77-1	31.01.	Grab	15:40	54° 57,429'	8° 15,342'	13.2	on deck
AL519/1_78-1	AL519/1_78-1	31.01.	Grab	15:49	54° 57,432'	8° 15,087'	12.4	in the water
AL519/1_78-1	AL519/1_78-1	31.01.	Grab	15:50	54° 57,427'	8° 15,088'	12.2	on deck
AL519/1_79-1	AL519/1_79-1	31.01.	Grab	15:51	54° 57,427'	8° 15,088'	12.1	in the water
AL519/1_79-1	AL519/1_79-1	31.01.	Grab	16:02	54° 57,258'	8° 15,078'	0.0	on deck
AL519/1_80-1	AL519/1_80-1	31.01.	Grab	16:14	54° 57,258'	8° 15,503'	12.8	in the water
AL519/1_80-1	AL519/1_80-1	31.01.	Grab	16:16	54° 57,254'	8° 15,492'	12.9	on deck
AL519/1_81-1	AL519/1_81-1	31.01.	Grab	16:27	54° 57,239'	8° 15,766'	13.1	in the water
AL519/1_81-1	AL519/1_81-1	31.01.	Grab	16:29	54° 57,238'	8° 15,749'	12.2	on deck
AL519/1_82-1	AL519/1_82-1	31.01.	Grab	16:38	54° 57,221'	8° 15,948'	13.0	in the water
AL519/1_82-1	AL519/1_82-1	31.01.	Grab	16:40	54° 57,224'	8° 15,941'	12.7	on deck
AL519/1_83-1	AL519/1_83-1	31.01.	Grab	16:53	54° 57,190'	8° 16,312'	11.8	in the water
AL519/1_83-1	AL519/1_83-1	31.01.	Grab	16:55	54° 57,190'	8° 16,288'	11.6	on deck
AL519/1_84-1	AL519/1_84-1	31.01.	Grab	17:03	54° 57,017'	8° 16,249'	12.0	on deck
AL519/1_84-1	AL519/1_84-1	31.01.	Grab	17:05	54° 57,000'	8° 16,282'	12.0	in the water
AL519/1_85-1	AL519/1_85-1	31.01.	Grab	17:12	54° 57,033'	8° 16,036'	12.2	in the water
AL519/1_85-1	AL519/1_85-1	31.01.	Grab	17:14	54° 57,034'	8° 16,041'	12.4	on deck
AL519/1_86-1	AL519/1_86-1	31.01.	Grab	17:22	54° 57,032'	8° 15,781'	12.3	in the water
AL519/1_86-1	AL519/1_86-1	31.01.	Grab	17:24	54° 57,028'	8° 15,801'	12.8	on deck

AL519/1_87-1	AL519/1_87-1	31.01.	Grab	17:31	54° 57,048'	8° 15,550'	12.6	in the water
AL519/1_87-1	AL519/1_87-1	31.01.	Grab	17:33	54° 57,048'	8° 15,571'	13.2	on deck
AL519/1_88-1	AL519/1_88-1	31.01.	Grab	17:41	54° 57,065'	8° 15,123'	12.5	in the water
AL519/1_88-1	AL519/1_88-1	31.01.	Grab	17:42	54° 57,059'	8° 15,132'	12.9	on deck
AL519/1_89-1	AL519/1_89-1	31.01.	Grab	17:50	54° 56,853'	8° 15,122'	12.3	in the water
AL519/1_89-1	AL519/1_89-1	31.01.	Grab	17:52	54° 56,839'	8° 15,137'	12.9	on deck
AL519/1_90-1	AL519/1_90-1	31.01.	Grab	18:04	54° 56,850'	8° 15,500'	13.0	in the water
AL519/1_90-1	AL519/1_90-1	31.01.	Grab	18:05	54° 56,840'	8° 15,507'	12.5	on deck
AL519/1_91-1	AL519/1_91-1	31.01.	Grab	18:19	54° 56,790'	8° 15,808'	11.9	in the water
AL519/1_91-1	AL519/1_91-1	31.01.	Grab	18:21	54° 56,786'	8° 15,796'	12.0	on deck
AL519/1_92-1	AL519/1_92-1	31.01.	Grab	18:30	54° 56,761'	8° 16,023'	13.0	in the water
AL519/1_92-1	AL519/1_92-1	31.01.	Grab	18:31	54° 56,757'	8° 16,028'	12.7	on deck
AL519/1_93-1	AL519/1_93-1	31.01.	Grab	18:39	54° 56,742'	8° 16,248'	11.9	in the water
AL519/1_93-1	AL519/1_93-1	31.01.	Grab	18:41	54° 56,759'	8° 16,256'	12.0	on deck
AL519/1_94-1	AL519/1_94-1	31.01.	Grab	18:51	54° 56,498'	8° 16,233'	11.8	in the water
AL519/1_94-1	AL519/1_94-1	31.01.	Grab	18:52	54° 56,497'	8° 16,236'	11.6	on deck
AL519/1_95-1	AL519/1_95-1	31.01.	Grab	18:59	54° 56,533'	8° 15,969'	12.3	in the water
AL519/1_95-1	AL519/1_95-1	31.01.	Grab	19:01	54° 56,530'	8° 15,971'	12.7	on deck
AL519/1_96-1	AL519/1_96-1	31.01.	Grab	19:08	54° 56,535'	8° 15,714'	12.8	in the water
AL519/1_96-1	AL519/1_96-1	31.01.	Grab	19:09	54° 56,533'	8° 15,716'	11.9	on deck
AL519/1_97-1	AL519/1_97-1	31.01.	Grab	19:18	54° 56,535'	8° 15,406'	12.3	in the water
AL519/1_97-1	AL519/1_97-1	31.01.	Grab	19:20	54° 56,540'	8° 15,401'	12.8	on deck
AL519/1_98-1	AL519/1_98-1	31.01.	Grab	19:27	54° 56,544'	8° 15,137'	12.7	in the water
AL519/1_98-1	AL519/1_98-1	31.01.	Grab	19:28	54° 56,540'	8° 15,146'	13.1	on deck
AL519/1_99-1	AL519/1_99-1	01.02.	ADCP	07:05	54° 15,964'	7° 58,215'	23.5	in the water
AL519/1_100-1	AL519/1_100-1	01.02.	ADCP	07:05	54° 15,958'	7° 58,210'	23.4	in the water
AL519/1_101-1	AL519/1_101-1	01.02.	SSS/MB/SES	07:05	54° 15,955'	7° 58,209'	23.2	in the water
AL519/1_101-1	AL519/1_101-1	01.02.	SSS/MB/SES	09:30	54° 15,828'	7° 59,476'	21.8	profile start
AL519/1_101-1	AL519/1_101-1	01.02.	SSS/MB/SES	12:17	54° 15,709'	7° 59,825'	21.0	on deck
AL519/1_101-1	AL519/1_101-1	01.02.	SSS/MB/SES	12:23	54° 15,582'	7° 59,981'	20.7	in the water
AL519/1_101-1	AL519/1_101-1	03.02.	SSS/MB/SES	10:20	54° 20,863'	7° 56,062'	22.8	profile end
AL519/1_101-1	AL519/1_101-1	03.02.	SSS/MB/SES	10:27	54° 21,171'	7° 55,762'	23.1	on deck
AL519/1_102-1	AL519/1_102-1	03.02.	Grab	10:57	54° 20,076'	7° 56,024'	23.9	in the water
AL519/1_102-1	AL519/1_102-1	03.02.	Grab	10:58	54° 20,074'	7° 56,030'	23.5	on deck
AL519/1_102-2	AL519/1_102-2	03.02.	UWVS	11:02	54° 20,068'	7° 56,046'	23.7	in the water
AL519/1_102-2	AL519/1_102-2	03.02.	UWVS	11:09	54° 20,067'	7° 56,034'	24.3	on deck
AL519/1_103-1	AL519/1_103-1	03.02.	CTD	11:24	54° 20,183'	7° 56,785'	22.9	in the water
AL519/1_103-1	AL519/1_103-1	03.02.	CTD	11:29	54° 20,182'	7° 56,756'	23.1	on deck
AL519/1_103-2	AL519/1_103-2	03.02.	Grab	11:31	54° 20,184'	7° 56,756'	23.1	in the water
AL519/1_103-2	AL519/1_103-2	03.02.	Grab	11:32	54° 20,184'	7° 56,760'	23.3	on deck
AL519/1_104-1	AL519/1_104-1	03.02.	Grab	11:54	54° 19,803'	7° 57,691'	23.1	in the water
AL519/1_104-1	AL519/1_104-1	03.02.	Grab	11:55	54° 19,798'	7° 57,684'	22.1	on deck
AL519/1_105-1	AL519/1_105-1	03.02.	Grab	12:13	54° 19,458'	7° 58,029'	22.8	in the water
AL519/1_105-1	AL519/1_105-1	03.02.	Grab	12:15	54° 19,457'	7° 58,039'	22.7	on deck
AL519/1_106-1	AL519/1_106-1	03.02.	Grab	12:27	54° 19,314'	7° 58,074'	22.8	in the water
AL519/1_106-1	AL519/1_106-1	03.02.	Grab	12:29	54° 19,314'	7° 58,073'	22.6	on deck
AL519/1_107-1	AL519/1_107-1	03.02.	CTD	12:48	54° 18,742'	7° 58,647'	22.1	in the water

AL519/1_107-1	AL519/1_107-1	03.02.	CTD	12:54	54° 18,761'	7° 58,647'	21.7	on deck
AL519/1_107-2	AL519/1_107-2	03.02.	Grab	12:55	54° 18,763'	7° 58,639'	21.8	in the water
AL519/1_107-2	AL519/1_107-2	03.02.	Grab	12:57	54° 18,771'	7° 58,638'	22.2	on deck
AL519/1_108-1	AL519/1_108-1	03.02.	Grab	13:14	54° 18,354'	7° 57,136'	24.5	in the water
AL519/1_108-1	AL519/1_108-1	03.02.	Grab	13:16	54° 18,358'	7° 57,122'	24.3	on deck
AL519/1_109-1	AL519/1_109-1	03.02.	Grab	13:32	54° 17,745'	7° 57,706'	24.7	in the water
AL519/1_109-1	AL519/1_109-1	03.02.	Grab	13:34	54° 17,753'	7° 57,699'	23.9	on deck
AL519/1_110-1	AL519/1_110-1	03.02.	CTD	14:13	54° 17,038'	8° 00,367'	20.9	in the water
AL519/1_110-1	AL519/1_110-1	03.02.	CTD	14:19	54° 17,050'	8° 00,376'	21.1	on deck
AL519/1_110-2	AL519/1_110-2	03.02.	Grab	14:20	54° 17,055'	8° 00,380'	20.8	in the water
AL519/1_110-2	AL519/1_110-2	03.02.	Grab	14:21	54° 17,061'	8° 00,389'	21.0	on deck
AL519/1_111-1	AL519/1_111-1	03.02.	Grab	14:36	54° 16,431'	7° 59,988'	22.0	in the water
AL519/1_111-1	AL519/1_111-1	03.02.	Grab	14:38	54° 16,433'	7° 59,989'	22.0	on deck
AL519/1_112-1	AL519/1_112-1	03.02.	SSS/MB/SES	14:44	54° 16,322'	8° 00,153'	22.0	in the water
AL519/1_112-1	AL519/1_112-1	03.02.	SSS/MB/SES	14:44	54° 16,318'	8° 00,163'	21.8	profile start
AL519/1_112-1	AL519/1_112-1	04.02.	SSS/MB/SES	07:59	54° 20,765'	7° 55,857'	21.7	profile end
AL519/1_112-1	AL519/1_112-1	04.02.	SSS/MB/SES	08:04	54° 20,843'	7° 55,577'	21.4	on deck
AL519/1_113-1	AL519/1_113-1	04.02.	ADCP	08:08	54° 20,899'	7° 55,475'	0.0	in the water
AL519/1_114-1	AL519/1_114-1	04.02.	ADCP	08:21	54° 20,981'	7° 55,191'	21.8	on deck
AL519/1_115-1	AL519/1_115-1	05.02.	Mooring	18:04	54° 54,513'	8° 10,372'	15.2	on deck
AL519/1_116-1	AL519/1_116-1	06.02.	ADCP	06:56	54° 15,215'	8° 01,238'	18.7	in the water
AL519/1_116-1	AL519/1_116-1	06.02.	ADCP	07:22	54° 16,090'	8° 00,352'	20.5	profile start
AL519/1_116-1	AL519/1_116-1	06.02.	ADCP	21:34	54° 19,375'	7° 56,830'	23.1	profile end
AL519/1_116-1	AL519/1_116-1	06.02.	ADCP	21:36	54° 19,407'	7° 56,817'	23.3	on deck

7 Data and Sample Storage and Availability

All recorded data, including sidescan sonar recordings, multibeam echo soundings, SES-2000 soundings and ADCP data as well as grain-size distributions of the sediment samples will be stored to the open access library PANGAEA, which guarantees long-term availability of its content.

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10 Abbreviations

ADCP = Acoustic Doppler Current Profiler

CTD = Conductivity, Temperature, Depth

Grab = VanVeen Grab Sampler

HSG = Study site „Helgoland Steingrund“

KAM = Study site „Kampen Survey Area“

MB = Multibeam Echosounder

SES = Sediment Echo Sounder

SSS = Sidescan Sonar

UWVS = Underwater Video System

VHF = very high frequency (radio signal)

WDA = Study site “Westerland Dredging Area”